# Redefining Clinically Significant Blood Loss in Complex Adult Spine Deformity Surgery

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INTRODUCTION:

**:** Excessive blood loss has historically been defined as an estimated blood loss (EBL) >4L. However, this threshold is not data driven and can be suboptimal for predicting adverse events (AE). This study aims to redefine clinically relevant blood loss in adult spinal deformity (ASD) surgery.

METHODS:

Patients undergoing complex adult spine surgery with more than 5 levels fused with open (n = 518) or MIS (n =34) techniques were included. Baseline patient specific blood volume was created based on Nadler's formular, incorporating sex and BMI. Estimated blood volume loss (EBVL) was then calculated by dividing EBL by the preoperative blood volume. Both EBVL and EBL were used to predict the occurrence of AE's related to blood loss based on expert panel and including cardiac, central nervous system, gastrointestinal, renal, and anesthesia and electrolyte-related complications before discharge, as well as infectious complications until 6 weeks postoperatively. Using Lasso regression, the top 5 variables were selected for logistic regression models to predict AEs. The receiver operating characteristics (ROC) curve was plotted and coefficients/odds ratio for all 5 variables were calculated. Additionally, EBVL/EBL was plotted against AE risk while controlling for the other 4 variables to determine the cutoff for clinically significant EBVL and EBL.

RESULTS:

Among 552 patients, 22.8% experienced adverse events (AEs). Lasso regression identified ASA score, pre-operative albumin, intraoperative crystalloids, and baseline hypertension as top predictors for AEs, along with EBL and EBVL. ROC curves showed AUC of 0.73 for EBVL and 0.83 for EBL. Clinically impactful thresholds were found to be 42% for EBVL and 2.3 liters for EBL (Figure 1). Patients exceeding these thresholds had AE rates of 31.3% and 36.4%, compared to <21% for those below. The new thresholds were below the median for all types of surgeries performed in the database.

DISCUSSION AND CONCLUSION: This investigation found that an EBL of 2.3 liters during complex ASD surgery is associated with clinically meaningful adverse events. After accounting for sex and BMI, a novel EBVL threshold was proposed and a cutoff of 42% of blood volume was found to be associated with an increased risk of adverse events and may be beneficial to utilize in adults who are substantial body weight outliers.